MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for April, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During April, 1904, barometric pressure was low over the British Isles and high over the middle longitudes of the Atlantic Ocean.

In the United States barometric disturbances were deficient in seasonal energy and, with one or two exceptions, were abnormally slow and erratic in their movements.

The first noteworthy American disturbance appeared on the eastern Rocky Mountain slope on the 6th and reached the Mississippi Valley on the 7th. On the morning of the 8th the disturbance was central over Iowa, with reported barometric minimum, 29.12 inches, at Des Moines. Heavy rain had fallen in the Mississippi, Ohio, and lower Missouri valleys, and the east Gulf States, and high winds were general throughout the central valleys and the upper Lake region. On the morning of the 9th the disturbance was central over the southern end of Lake Michigan, with barometric pressure 29.44 at Chicago. Snow was falling in the upper Lake region and upper Mississippi Valley, the rain area had extended to the north Atlantic coast, and freezing temperature was reported in the West and Northwest. During the 9th the disturbance moved northeastward over Michigan with rapidly diminishing strength.

A disturbance of moderate intensity moved eastward over the Great Lakes during the 11th.

On the 15th a disturbance moved rapidly eastward over the Mississippi and Ohio valleys, and reached the southeastern New England coast on the morning of the 16th, attended by high winds that attained a velocity of 72 miles an hour from the northwest at New York. By the evening of the 16th the center of disturbance had disappeared in the direction of Newfoundland. The passage of the storm was attended by heavy snow and high winds in the Lake region, in anticipation of which the following warning, based upon the morning reports of the 15th, was telegraphed to lower Lake stations:

> Heavy snow and high easterly shifting to northerly winds indicated for the lower Lake region to-night.

By the morning of the 16th three to twelve inches of snow had fallen in the Lake region.

From the 23d to the 27th a disturbance moved slowly eastward from the Plateau region to the Virginia coast, attended throughout its course by heavy rain and high winds. On the 24th severe local storms and torrential rains were reported in areas in the West and Southwest, and freshets occurred in the smaller streams of eastern Kansas. During the 25th heavy rain continued in the lower Missouri Valley, causing rivers to rise rapidly. Along the smaller streams of that section considerable farm property was flooded. At Jefferson City, Mo., the Missouri River rose above the danger line. On the 26th the Mississippi River at St. Louis reached a stage of 31.5 feet, and the river continued to rise at that point until 6 p. m. of the 29th, when a stage of 33.6 feet was reached. The usual advices regarding the rise in the lower Missouri and the Mis-

sissippi, below the mouth of the Missouri, were issued in time to serve all interests concerned.

During the second decade of the month melting snow in the mountains caused rapidly rising stages in the rivers of the north Pacific coast. Owing to ample warnings very little damage resulted.

From the 17th to the 22d heavy frost occurred in the Ohio Valley and the Middle Atlantic States, and on the 20th frost was general in Maryland, Virginia, and northern portions of Georgia and the interior of the Carolinas.

NEW ENGLAND FORECAST DISTRICT.

Viewing the month as a whole the weather was very unpleasant, the temperature being exceptionally and uniformly low and the precipitation decidedly in excess of the average. A storm of marked severity, considering the season, accompanied by very heavy rain and strong to high northeast gales prevailed during the 27th and 28th. The gales were of unusual force along the southern New England coast, and by many were considered the heaviest ever known at this time of the year. All shipping remained in the harbor, timely warnings having been given of the approaching storm and, so far as known, no casualties resulted.—*J. W. Smith, District Forecaster.*

WEST GULF FORECAST DISTRICT.

The month opened with showery weather over the greater portion of the district and showers were reported from some part of the district every day during the first nine days. These conditions were generally covered in the forecasts. Frost occurred in the northern portion of the district on the 10th and 13th, for which warnings were issued. Warnings for frost were issued for other dates, on most of which the temperature fell to about the frost point.

No general storm occurred along the Gulf coast during the month. Conditions appeared which warranted the issue of warnings on three dates.—*I. M. Cline, District Forecaster.*

NORTH CENTRAL FORECAST DISTRICT.

Unseasonably cool weather prevailed over this forecast district during the entire month. No general cold-wave warnings were issued, and the storm-warning service on the upper Lakes was not in operation on account of the lateness of the season. Advices were sent to ports on Lake Michigan for the benefit of the companies which maintained winter navigation. No casualties occurred during the month.—*H. J. Cox, Professor and District Forecaster.*

ROCKY MOUNTAIN FORECAST DISTRICT.

No severe storms occurred during the month. Frosts were frequent, but there was no serious damage; as a rule their occurrence was accurately forecast.—*F. H. Brandenburg, District Forecaster.*

SOUTH PACIFIC FORECAST DISTRICT.

The month was, as a whole, uneventful and in decided contrast to the preceding month, which was one of frequent and heavy rainfalls. At the beginning of April moderate showers fell throughout California. There appeared to be a tendency for depressions forming in the intermountain region to move rapidly southward over the Valley of the Colorado. A slow-moving area of high pressure rested over the western half of the country from April 5 to 12, and was accompanied by generally pleasant weather on the Pacific slope. On April 14 a well-marked depression moved southward on the western edge of the high, and for several days following the disturbance seemed to linger over Utah and Arizona. On April 18 a moderate depression overlay the Pacific slope, and high southerly winds and generous rains were reported generally on the 19th.

Light to heavy frosts occurred on the morning of the 20th, following the eastward march of the depression. On the morning of April 21 the disturbance crossed the Rocky Mountains. Another marked depression appeared over Nevada on the morning of the 26th.—*A. G. McAdie, Professor and District Forecaster.*

NORTH PACIFIC FORECAST DISTRICT.

Several damaging frosts occurred in the North Pacific States during April, for which timely warnings were issued. The winds were moderate and storm warnings were only issued on two occasions.

The most noteworthy feature was an unusually severe hot spell beginning on the 7th and lasting until the 15th, which caused the snow in the foothills to melt very fast and all rivers, creeks, and lakes in this district to rise rapidly. This hot spell was followed by temperatures, as a rule, below normal, with the result that the snow afterwards melted more gradually, and, except in a few small streams, no damaging floods occurred.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The April flood in the lower Mississippi Valley passed into the Gulf of Mexico without exciting apprehensions beyond those that would naturally be caused by any flood, and with but little or no damage or inconvenience. In the Memphis district alone were any fears expressed. The river at Memphis reached a stage of 39.0 feet on April 10, but 1.1 feet below the great high-water mark of the previous year, and it was thought that possibly the weak places in the levees at Luxora and Golden Lake, Ark., might give way, and also that the enormous strain would prove too powerful for the levees in the St. Francis district. Fortunately, none of these fears were realized; the river remained stationary at 39.0 feet from the 10th to the 12th, inclusive, and then began to fall, passing below the danger line of 33.0 feet during the morning of the 22d. Below Memphis the stages reached were from 3.0 feet to 6.0 feet lower than those of 1903, and nothing of unusual interest was chronicled. The usual warnings were issued about ten days in advance of the flood waves, and no reports of loss or damage have been received.

The heavy rains of the 23d–26th, inclusive, over the lower Missouri and upper Mississippi watersheds, caused the rivers to rise to the danger lines at almost all points, and in some places somewhat higher. In the lower Kansas River there were fears of a repetition of the disasters of 1903, but they were soon allayed by the early cessation of the rains. The Weather Bureau warnings of the floods enabled all interested to remove or protect their property whenever effective measures were possible. However, many thousand acres of bottom lands along the Mississippi River which had been planted to wheat were overflowed and the wheat was almost totally destroyed. The bottoms opposite Louisiana, Mo., which were submerged during the great floods of 1903, due to a crevasse in the Sny levee, were again overflowed, and it is estimated that about 30,000 acres of wheat were overflowed. Much of the overflowed land has been planted in corn since the subsidence of the waters.

The following report on the flood at Hannibal, Mo., and vicinity was made by Mr. B. L. Waldron, Official in Charge, United States Weather Bureau office, Hannibal, Mo.:

The river was 0.9 foot above the danger line on the first of the month, but fell steadily until the 22d, except that a slight rise occurred from the 8th to the 11th. The heavy rains in Missouri and southern and central Iowa from the 24th to the morning of the 26th caused an unusually rapid rise in the river in the vicinity of Hannibal; the danger line was passed on the 25th, and the crest was reached on the 28th, with a stage of 16.4 feet.

Flood warnings were issued at 10:45 a. m. of the 26th, and it was then estimated that a stage of about 17 feet would be reached on the 28th; on the 27th those interested were advised that the crest would arrive on the 28th with a stage a little above 16 feet.

The Salt River overflowed its banks by the morning of the 25th, and extensive wheat fields and other lowlands were overflowed. Bear Creek cross levee, Indian Grave district, broke on the 23d, and a considerable